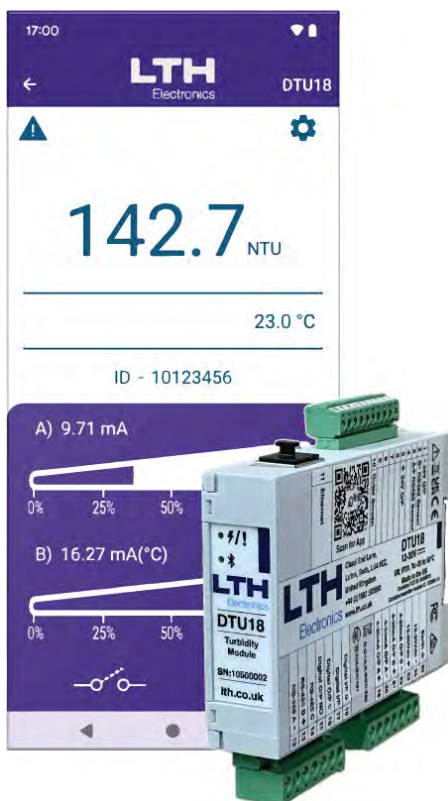


DTU18

Turbidity & Suspended Solids Measurement Module & LTH Discover App



Operation Guide

Preface

Product warranty

The DTU18 Turbidity & Suspended Solids Measurement Module has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

The foregoing warranty does not cover damage caused by accidental misuse, abuse, neglect, misapplication or modification.

No warranty of fitness for a particular purpose is offered. The user assumes the entire risk of using the product. Any liability of LTH is limited exclusively to the replacement of defective materials or workmanship.

Disclaimer

LTH Electronics Ltd reserves the right to make changes to this manual or the module without notice, as part of our policy of continued developments and improvements.

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Manufacturing Standards



Radio Equipment

This product has been designed to comply with the standards and regulations set down by both the United Kingdom RED Regulations S.I. 2017 No. 1206 and the European RED 2014/53/EU using EN IEC 61326-1 : 2021, ETSI EN 300 328 V2.2.2, ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-17 V3.2.4 and EN IEC 61010-1 : 2010.

Restriction of Hazardous Substances

This module has been produced to comply with the standards and regulations set down by both the United Kingdom Equipment Restriction of Hazardous Substances Regulations S.I. 2012/3032 and the European Restriction of Hazardous Substances Directive 2011/65/EU using BS EN IEC 63000 : 2018.

Quality

This module has been manufactured under the following quality standard:

ISO 9001:2015. Certificate No: FM 13843

Note: The standards referred to in the design and construction of LTH products are those prevailing at the time of product launch. As the standards are altered from time to time, we reserve the right to include design modifications that are deemed necessary to comply with the new or revised regulations.

Disposal



As per regulation S.I. 2012/3032 and directive 2012/19/EU, please observe the applicable local or national regulations concerning the disposal of waste electrical and electronic equipment.

Declaration of Conformity

UK Declaration of Conformity			Chaul End Lane Luton Bedfordshire LU4 8EZ United Kingdom
We,	LTH Electronics Ltd	declare under our sole responsibility that the produce / products	
Product identification	DTU18		
to which this declaration relates is/are in conformity with all essential requirements of the UK statutory requirements relating to:			
Radio Equipment Directive Hamonised Standards	SI 2017 No. 1206 EN IEC 61326-1 : 2021 ETSI EN 300 328 V2.2.2 ETSI EN 301 489-1 V2.2.3 ETSI EN 301 489-17 V3.2.4 EN IEC 61010-1 : 2010		
RoHS Directive Hamonised Standards / Harmonisierte Normen / Normes Harmonisées	SI 2012 No. 3032 EN 63000: 2018		
Place and date of issue / Ausstellungsort, -datum / Lieu et date d'émission	Luton, 07th May 2025  Neil Adams Managing Director		

EU Declaration of Conformity

EU-Konformitätserklärung

Déclaration UE de Conformité



Chaul End Lane
Luton
Bedfordshire
LU4 8EZ
United Kingdom

We, / Wir, die, / Nous,

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erklären in alleiniger Verantwortung, dass dieses Produkt / diese Produkte,
déclarons sous notre seule responsabilité que le produit / les produits,

Product identification /
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Désignation du produit

DTU18

to which this declaration relates is/are in conformity with all essential requirements of the Council Directives relating to:
auf welche(s) sich diese Erklärung bezieht, mit allen wesentlichen Anforderungen der folgenden Richtlinien des Rates
übereinstimmen:
auquel/auxquels se réfère cette déclaration est/sont conforme(s) aux exigences essentielles de la Directives du Conseil relatives à:

Radio Equipment Directive /
Funkanlagen-Richtlinie / Directive sur
les Equipements Radioélectriques

2014/53/EU

Hamonised Standards /
Harmonisierte Normen /
Normes Harmonisées

EN IEC 61326-1 : 2021
ETSI EN 300 328 V2.2.2
ETSI EN 301 489-1 V2.2.3
ETSI EN 301 489-17 V3.2.4
EN IEC 61010-1 : 2010

RoHS Directive /
RoHS-Richtlinie /
Directive RoHS

2011/65/EU

Hamonised Standards /
Harmonisierte Normen /
Normes Harmonisées

EN 63000: 2018

Place and date of issue /
Ausstellungort, -datum /
Lieu et date d'émission

Luton, 07th May 2025



Neil Adams
Managing Director

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Introduction

The DTU18 is a microprocessor-controlled Turbidity & Suspended Solids measurement module that can be used with digital sensors TU8325/TU8525 (turbidity) and TU8355/TU8555 (suspended solids) to measure and control a broad spectrum of solution turbidity. The module is compatible with standard 35mm top-hat DIN rail and is powered by 12-30VDC.

0/4-20mA Outputs

The module features two industry standard, isolated, 0/4-20mA current outputs that features adjustable scaling, selectable on-error states and loop fault detection. Either allows the module to transmit the primary reading or observed process temperature for remote monitoring purposes.

Modbus

Additionally, the module features an optional Modbus interface via either RTU or ASCII over RS-485, or TCP/IP over Ethernet. Using the interface, the module's measurements can be read, status checked, configurations changed, and calibrations performed.

Note, by default the Modbus functionality is locked, and requires an additional purchase to unlock. This can be done at the time of ordering the module or alternatively may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module.

Digital Input & Digital Output

Also present are a single digital input and a single digital output. The digital input features a dry contact input which allows the module to be remotely set to either an offline state that forces the current outputs to a pre-defined state, or to change the whole configuration of the module by switching the setup to a preconfigured state.

The digital output consists of a volt free, single pole, single throw normally open relay, which can be configured to clean the sensor by activating a separate jet spray wash or rotary electrode cleaning system on a timed cycle with adjustable duration, interval and recovery. Alternatively, the output can be used to indicate the module alarm status.

Status LEDs

Finally, two status LEDs on the front of the module indicate the operation status of the of the module and the Bluetooth connection.

Bluetooth

To achieve this all within in a small foot print the module features no display. Instead, a separate mobile app, **LTH Discover** that can be downloaded from all major app stores, is used to connect to the module via Bluetooth and display the primary reading and temperature, show operational status and to provide an intuitive means to configure and calibrate the module.

If multiple modules are within range **LTH Discover** can display the measurement readings and operation status of all of them within the app's discovery screen.

DTU18 Specification

Measurement Input	TU8325 and TU8525, Digital Turbidity Sensors. TU8355 and TU8555, Digital Suspended Solids Sensors.	
Connection Cable	Up to 30 meters.	
Ranges of Measurement	TU8325 and TU8525 0-4.000 NTU 0-40.00 NTU 0-400.0 NTU TU8355 and TU8555 0-99.9 FTU 0-999 FTU 0-9999 FTU	
Accuracy	<1% of the full scale selected	
Operator Adjustment	Zero	TU8325 and TU8525 ±0.400 NTU on all scales TU8355 and TU8555 ±10 FTU on all scales
	Span	70 – 130 %
Calibration Methods	Automatic Zero and Span calibration using user entered solution values	
Measurement Faults	The sensor can indicate problems that affect the measurement, such as dirt on the optical windows, lack of contact with liquid and external light too high.	
Sensor Input Filter	The sensor has a filter with two selectable response time. The user can separately set the response time relative to signals of small or large variation to obtain good reading stability and fast response to the variations of the measurement in the process.	
Conversion (TU8355 and TU8555 only)	Conversion between the raw suspended solids reading and scaled value. Uses either the sensors built in Total Suspended Solids (TSS) system, which uses a TSS/FTU factor to produce an equivalent reading, or the module's user set 11 point solution curve.	
Temperature Sensor	RTD Pt100 (built-in to sensor)	
Range of Temperature Measurement	0-50.0 °C	
Temperature Compensation Coefficient	Internal table applied to the measurement by the sensor.	
Off-Line Facility	The current outputs are held at a user defined level.	
Digital Input	Dry contact input for remote activation of user defined operations. Can be configured to operate in either normally open or normally closed modes.	

Current Outputs Specification	Two current outputs as standard, selectable 0-20mA or 4-20mA into 750 ohms max, the pair of outputs are fully isolated to 2kV from the rest of the module. Expandable to 100% of any operating range and offset anywhere in that range.		
Current Outputs Adjustment	3-point 0/4-20 mA for remote monitor calibration.		
Digital Output	Volt free, single pole, single throw, normally open, 24v AC/DC max, 750mA max.		
Digital Output Mode	Module alarm status Cleaning to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Adjustable duration, interval and recovery.		
Modbus	If optional, module features Modbus communication over either RS485 or Ethernet. Allowing for remote access to readings, configuration changes and calibration of the module. Can be specified at time of purchase or activated later using a module specific unlock code.		
RS-485 Modbus Interface	RTU and ASCII protocol, 300Bps to 38400Bps baud rate, None-Odd-Even parity bits, 1-2 stop bits.		
TCP/IP Over Ethernet Interface	Manual or automatic (via DHCP server support) network configuration. Port link and activity status LEDs		
Bluetooth	Integrated Bluetooth radio. 25 meters max operating range.		
Mobile App	Separate LTH Discover app provides an easy to use and intuitive means of commissioning, monitoring and calibrating the module from mobile devices via the Bluetooth interface. Available to download from major app stores, requires iOS 13.2 and later or Android 6.0 and up.		
Radio Equipment Directive	SI 2017 No. 1206 & 2014/53/EU		
Power Supply	12-30V DC, 4W max.		
Module Housing	PA 6.6-FR (UL 94 V0)		
Ingress Protection Rating	IP20.		
Ambient Operating Conditions	Sensor	Temperature	-5 to 50°C max,
		Pressure	0 to 6 bar @ 25°C 0 to 3 bar @ 50°C
	Module	Temperature -20 to +55°C, Relative Humidity 5 to 95%, non-condensing.	
Weight	Maximum 160 grams (module only).		
Dimensions	104 x 23 x 111 mm (H, W, D) including connectors.		
Mounting	Compatible with 35 x 7.5mm and 35 x 15mm top hat section DIN rail (IEC 60715)		

Installation – Safety & EMC

This chapter describes how to install the module and how to connect the unit to a power source and auxiliary equipment.

Although today's electronic components are very reliable, it should be anticipated in any system design that a component could fail, and it is therefore desirable to make sure a system will **fail safe**. This could include the provision of an additional monitoring device, depending upon the particular application and any consequences of a module or sensor failure.

Wiring Installation

The specified performance of the module is entirely dependent on correct installation. For this reason, the installer should thoroughly read the following instructions before attempting to make any electrical connections to the unit.

CAUTION ! : ALWAYS REMOVE THE MAIN POWER FROM THE SYSTEM BEFORE ATTEMPTING ANY ALTERATIONS TO THE WIRING. ENSURE THAT BOTH POWER INPUT LINES ARE ISOLATED. MAKE SURE THAT THE POWER CANNOT BE SWITCHED ON BY ACCIDENT WHILST THE UNIT IS BEING CONNECTED. FOR SAFETY REASONS AN EARTH CONNECTION MUST BE MADE TO THE EARTH TERMINAL OF THIS MODULE.

LOCAL WIRING AND SAFETY REGULATIONS SHOULD BE STRICTLY ADHERED TO WHEN INSTALLING THIS UNIT. SHOULD THESE REGULATIONS CONFLICT WITH THE FOLLOWING INSTRUCTIONS, CONTACT LTH ELECTRONICS OR AN AUTHORISED LOCAL DISTRIBUTOR FOR ADVICE.

To maintain the specified levels of Electro Magnetic Compatibility (EMC, susceptibility to and emission of electrical noise, transients and radio frequency signals) it is essential that the types of cables recommended within these instructions be used. If the installation instructions are followed carefully and precisely, the module will achieve and maintain the levels of EMC protection stated in the specification. Any equipment to which this unit is connected must also have the same or similar EMC control to prevent undue interference to the system.

❖ Terminations at the connectors should have any excess wire cut back so that a minimal amount of wire is left free to radiate electrical pick-up inside or close to the module housing.

N.B. The use of CE marked equipment to build a system does not necessarily mean that the completed system will comply with the European requirements for EMC.

Noise suppression

In common with other electronic circuitry, the module may be affected by high level, short duration noise spikes arising from electromagnetic interference (EMI) or radio frequency interference (RFI). To minimise the possibility of such problems occurring, the following recommendations should be followed when installing the unit in an environment where such interference could potentially occur.

The following noise generating sources can affect the module through capacitive or inductive coupling.

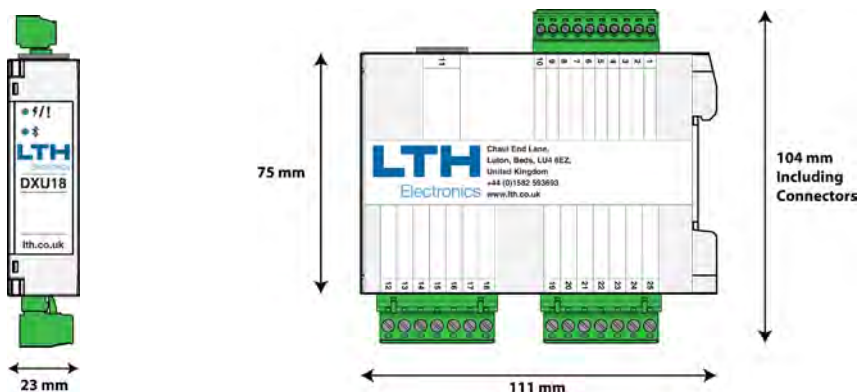
- ❖ Relay coils
- ❖ Solenoids
- ❖ AC power wires, particularly at or above 100V AC
- ❖ Current carrying cables
- ❖ Thyristor field exciters
- ❖ Radio frequency transmissions
- ❖ Contactors
- ❖ Motor starters
- ❖ Business and industrial machines
- ❖ Power tools
- ❖ High intensity discharge lights
- ❖ Silicon control rectifiers that are phase angle fired

The module is designed with a high degree of noise rejection built in to minimise the potential for interference from these sources, but it is recommended that you apply the following wiring practices as an added precaution. Cables transmitting low level signals should not be routed near contactors, motors, generators, radio transmitters, or wires carrying large currents.

If noise sources are so severe that the module's operation is impaired, or even halted, the following external modifications should be made, as appropriate:

- ❖ Fit arc suppressors across active relay or contactor contacts in the vicinity.
- ❖ Run signal cables inside steel tubing as much as is practical.
- ❖ Use the internal relays to switch external slave relays or contactors when switching heavy or reactive loads.
- ❖ Fit an in-line mains filter close to the power terminals of the module.

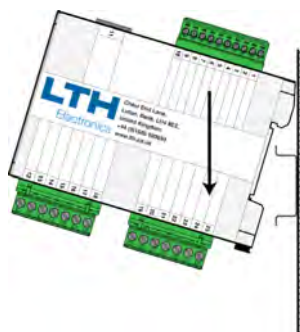
Enclosure



DTU18 Overall Dimensions

The enclosure is designed to attached to standard DIN EN 60715 / TH 35mm DIN-rail.

It should be attached to the rail by following the below guide.



Tilt the module and attach the top edge of the module's rail clip to the rail



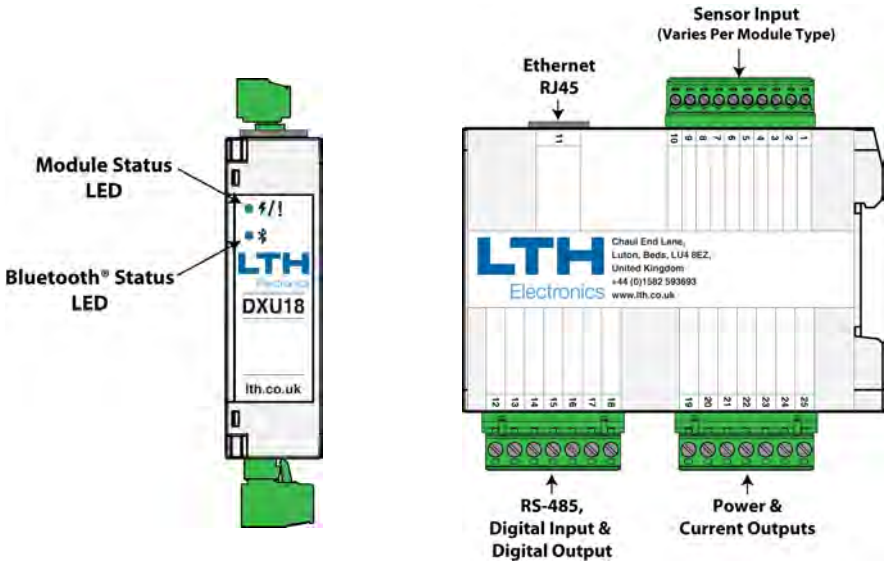
Rotate the module downwards



The spring clip in the bottom of the module's rail clip should click onto the rail

To remove the module from the rail, insert a slotted screwdriver into the module's rear rail clip and pull the clip downwards to disengage the clip from the rail, then follow the above but in reverse.

Module Overview



DTU18 Overview

Status LEDs

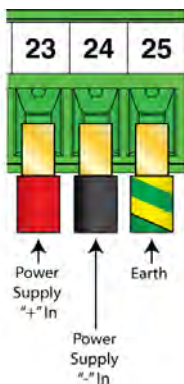
⚡/!	Module Status LED	
○	Off	Module Unpowered
●	Constant Red	Module Initialising
⏏ ●	Flashing Green	Module Running
⏏ ●	Flashing Red	Module Error

📶	Bluetooth® Status LED	
○	Off	Module Unpowered
⏏ ●	Flashing Blue	Bluetooth Unconnected
●	Constant Blue	Bluetooth Connected

DTU18 LEDs

Supply Voltage Connections

Refer to the label adjacent to the power supply terminals for the input voltage limits. Exceeding these limits may damage the module.

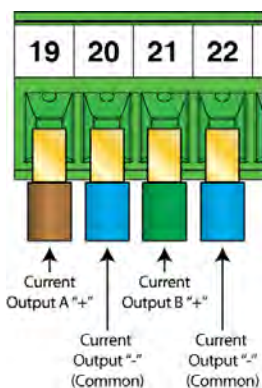


12-30V DC Power Connections

The incoming Earth connection must be connected to the Earth terminal.

Current Output Connections

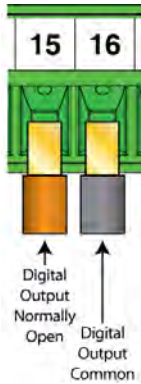
The DTU18 is supplied as standard with two current outputs, either of which can terminate into a load resistance not exceeding 750Ω and are both galvanically isolated from the rest of the module. For best noise immunity use a screened twisted pair cable, with the screen connected to Earth at one end. Use a sufficiently large cable to avoid a high resistance in the overall current loop.



Current Outputs Connection Detail

Digital Output Connections

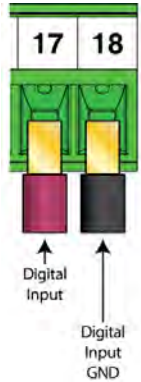
The DTU18 is supplied with a single volt free, single pole, single throw, normally open relay. Maximum switching voltage of **24v AC/DC**, maximum load **750mA**. To switch a higher voltage or load will require a slave relay.



Digital Output Connection Details

Digital Input Connections

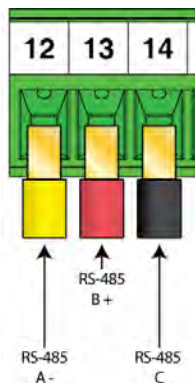
The DTU18 features a single dry contact digital input, which can be used to initiate a user configurable module operation by use of a volt free link, switch or relay. The module can be configured to initiate the appropriate action when the contact either closes or opens.



Digital Input Connection Details

Modbus Connections

The DTU18 features optional Modbus communications over either RS485 or Ethernet. Allowing for remote access to readings, configuration changes and calibration of the module. Note, the module can only be set to use either the RS485 interface or the Ethernet interface, they cannot both be used at the same time.



Modbus RS485 Connection Details

Note, the module does not feature an internal RS485 120Ω terminating resistor.



Modbus TCP/IP Ethernet RJ45 Connection

Ethernet connection uses standard RJ45 connector and termination, remove connector dust cap before use. Integrated ethernet status LEDs – Green – Good link, Yellow – Activity on link.

Installation and Choice of Turbidity & Suspended Solid Sensors

The DTU18 is compatible with the two digital turbidity sensors – TU8325 and TU8525, and the two digital suspended solids sensors – TU8355 and TU8555. The sensors have been designed to measure turbidity values according to the nephelometric Method (EN 27027) for use with drinking water, civil and industrial treatment, and water quality monitoring.

The sensors feature a measuring system comprising of an infrared light source, a 90-degree scattered light detector, a clean lens status detector, and a temperature sensor.

The TU8325 & TU8525 are designed for submersible applications and are provided with an auto clean nozzle for external pressured air ensuring the sensing lenses are clean of any contamination.

Whilst the TU8525 & TU8555 are designed for in flow applications for insertion into a flow cell or pipe.

For both sensors the measurement performance is identical.

Digital Interface

The sensors communicate with the DTU18 via a digital interface. Each sensor has a unique sensor address number which is equal to the last digit of the sensor's serial number, except for 0 which is equal to an address of 10. The address must be entered into the interface address item of the channel menu. If no sensor is connected or the interface has not been configured correctly in the channel menu, then a Sensor Communication Error E25 will be shown, the sensor reading will change to ---, and the module will automatically go offline.

Installation of TU8325 & TU8555 when using the Autoclean system:

The sensor should be submerged preferably with an inclination that favours cleaning air escaping upwards.

To help with ease of mounting various fittings is available – please contact LTH for further information.

Before the immersion of the sensor, it is necessary to make the following:

- Prepare an extension pipe with suitable length
- Prepare the PVC tubing with suitable length
- Prepare any sourced adapters
- Insert the flexible tubing in the air connector located at the rear of the sensor
- Insert the cable and the tubing in any supplied adapters and screw it on the sensor
- Insert the extension pipe and screw it to the adapter

! The pressurised air used must be clean and at 3 bar max. The typical cleaning time is 15 seconds, and the typical cleaning frequency is 2 times/day, but it is depending on the application and the actual efficiency of the cleaning action. Higher cleaning frequency could reduce the lifetime of optical lens, especially in the presence of abrasive suspended solids in the sample.

! Do not unscrew / remove the cable gland fitting. Doing so may result in permanent damage to the sensors electronics.

Installation of TU8325 & TU8555 when not using the Autoclean system:

Before the immersion of the sensor, follow the above procedure but:

- Do not install the PVC tubing
- Install a stopper on the sensor's airline connector to avoid water entering the space between the Autoclean adapter and the sensor.

- ! Without the installed airline stopper water will damage the cable and possibly result in damage to the sensors electronics.
- ! The sensor can be submerged but chemical compatibility against the sensor cable's PVC jacket must be checked. In any case it is recommended that the cable is periodically checked to ensure it is in good condition.
- ! Do not unscrew / remove the cable gland fitting. Doing so may result in permanent damage to the sensors electronics.

Installation of TU8525 & TU8555

These sensors are primarily designed for use either online or in a flow cell, though it is advised to use a flow cell with the TU8525 for applications below 40 NTU. TU910, a specifically designed flow cell, is available from LTH.

In suspended solids applications the sensor can also be installed directly in the flow, preferably in a bypass with shut-off valves to allow the removal of the sensor for maintenance.

The sensor can also be installed in a tank with extension pipe adapters again available from LTH.

- ! Do not unscrew / remove the cable gland fitting. Doing so may result in permanent damage to the sensors electronics.

Operating Principle

The turbidity measurement is based on the EN 27027 standard.

A light beam is sent to the sample through an optical lens. The 90-degree scattered light by suspended particle is collected by the sensor through a second lens and it is converted in an electric signal proportional to the turbidity of the sample.

The sensors use an infrared light so the measuring is not affected by the colour of the sample.

External light effect

The exposure of the sensors to high external light can influence the turbidity measurement. The circuit of the sensor can detect the external light that may be affecting the accuracy of the measuring.

If the effect cannot be automatically compensated, an error message will be shown (see page 63).

The user must modify the installation to protect the lens from the sun or the stray light.

Maintenance

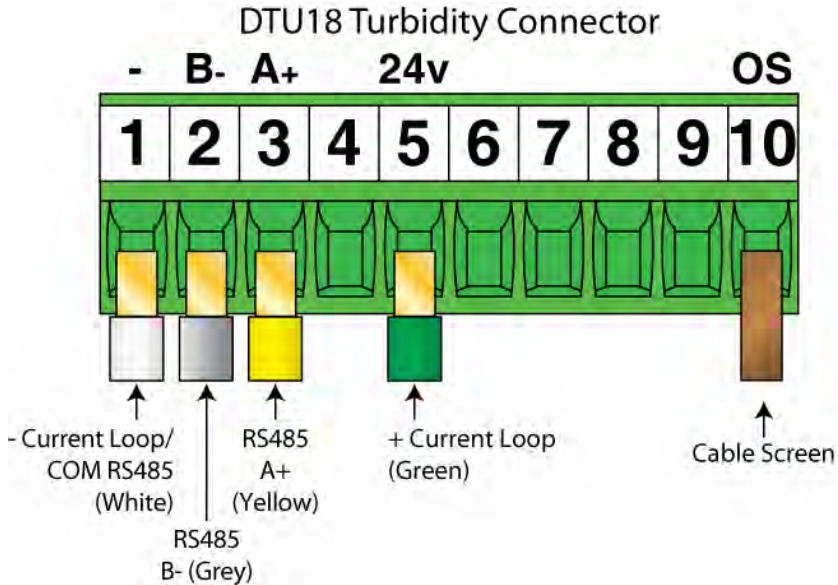
The two optical lenses at the bottom of the sensor should be inspected and cleaned periodically.

Cleaning is recommended before zero and sensitivity calibration.

Remove any deposit on the optical lens by using a soft, damp cloth or paper towel without pushing on the surface to avoid scratching it. If necessary, use a soft detergent or a very dilute acid if the deposits are of limestone type.

The frequency of cleaning depends on the type of use, the nature, and the concentration of the measuring sample.

DTU18 Sensor Input Connection Details



Turbidity & Suspended Solids Sensor Connection Details

- ! Do not connect a power supply to the sensor's RS485 interface wires (yellow and grey) to prevent damage to the sensor's electronics.

- ! To enable correct operation the sensor's address must be entered into the interface address option in the channel menu.
 The address is equal to the last digit of the sensor's serial number (note, if the last digit is 0 then the address is 10).
 The serial number can be found on either the body of the sensor or at either end of the sensor cable.

CAUTION! BEFORE PROCEEDING, ENSURE THAT THE INSTALLATION INSTRUCTIONS HAVE BEEN FOLLOWED CORRECTLY. FAILURE TO DO SO MAY RESULT IN AN ELECTRICALLY HAZARDOUS INSTALLATION OR IRREPARABLE DAMAGE TO THE MODULE.

LTH Discover App

Complementing the DTU18 module is a separate mobile app, **LTH Discover** which can be downloaded from all major app stores.



LTH Discover App

The app can be used to connect to the module via Bluetooth and display the primary reading and temperature, show operational status and to provide an intuitive means to configure and calibrate the module.



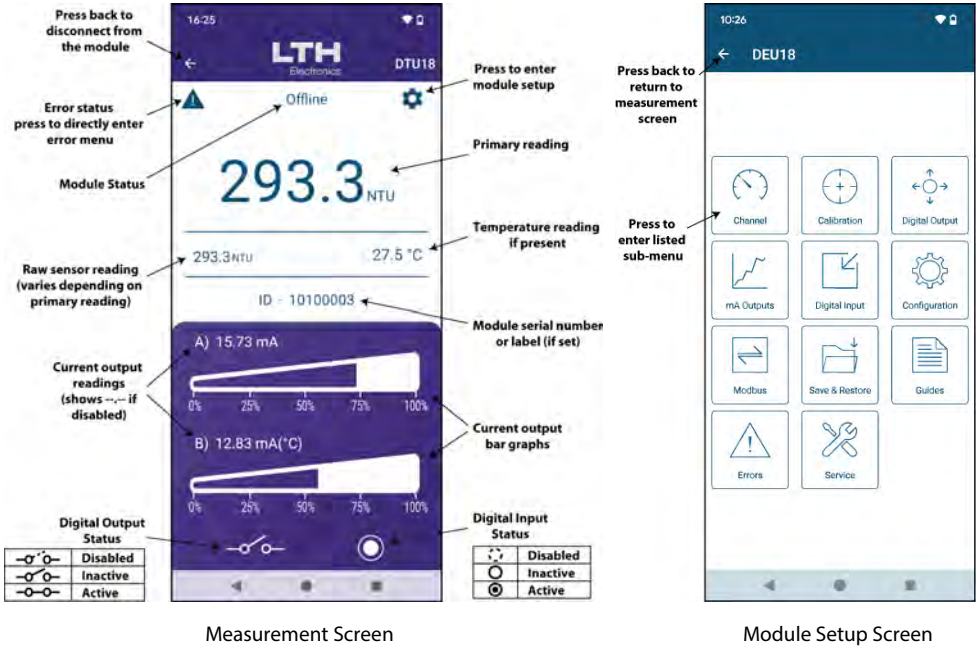
Opening Screen



Discovery Screen

On opening the app press the Discover Module button to enter the discovery screen. The discovery screen shows all the modules within in range along with their current sensor and temperature readings, error status, the model type, and either the serial number or if set the module's label. Click on the desired module to connect.

Note, during connection the app will check if the module is running the latest firmware to ensure compatibility between the app and the module, if not the user is given the optional ability to update it.



Measurement Screen

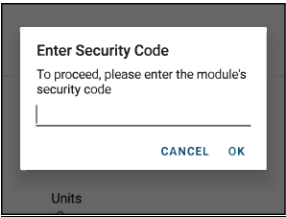
Module Setup Screen

Once connected the app shows the Measurement screen which can be used to view the primary, temperature, and raw sensor readings; module, digital input, digital output and error statuses; and current output readings. Pressing the gear icon enters the module setup screen from which the user can configure and calibrate the module. Note, if the Modbus menu is greyed out then the interface requires unlocking on the connected module, see 54 page for more details.

Security Code Access

To protect the module setup from unauthorised or accidental tampering when using the app, a security access code system is present. This is implemented via the module's menu system which operates in two modes, "locked" and "unlocked". The locked mode allows the user to observe the module's configuration but without the ability to change it. If the user wishes to change a setting, then the "Security Code" menu will appear that will prompt them to enter the security code which will then change the module's mode to "unlocked". Once unlocked, the user can change any setting without having to re-enter the security access code whilst the app remains connected to the module, however the module will automatically lock itself if the app disconnects.

The user can change the module's access code in the security code section of the configuration menu, or alternatively they can disable the module's security system permanently by changing the access code to 0000.



The default security code is 1000

Main Measurements

In addition to using the mobile app, the module's main measurements can be accessed using the Modbus interface and the registers as listed below. See Modbus section (page 56) for further details about the using the interface.

Description	Register/s	Type	Access	Option	Value
Module Type	2000	Int	Read	Turbidity & Suspended Solids	6

Description	Register/s	Type	Access	Option	Value
Main Reading Status	2001	Int	Read	Sensor Present	0
				No Sensor Present	1

Description	Register/s	Type	Access	Format	Units
Main Reading Value	2002	Float	Read	See register 2004	See register 2004

Description	Register/s	Type	Access	Option	Value
Main Reading Format and Units	2004	Int	Read	X.XXX NTU	1
				XX.XX NTU	2
				XXX.X NTU	3
				XX.X FTU	4
				XXX FTU	5
				XXXX FTU	6
				X.XXX %	7
				XX.XX %	8
				XXX.X %	9
				XXXX %	10
				X.XXX ppt	11
				XX.XX ppt	12
				XXX.X ppt	13
				XXXX ppt	14
				X.XXX ppm	15
				XX.XX ppm	16
				XXX.X ppm	17

Description	Register/s	Type	Access	Option	Value
<i>Main Reading Format and Units Continued</i>				<i>XXXX ppm</i>	<i>18</i>
				<i>X.XXX ppb</i>	<i>19</i>
				<i>XX.XX ppb</i>	<i>20</i>
				<i>XXX.X ppb</i>	<i>21</i>
				<i>XXXX ppb</i>	<i>22</i>
				<i>X.XXX g/l</i>	<i>23</i>
				<i>XX.XX g/l</i>	<i>24</i>
				<i>XXX.X g/l</i>	<i>25</i>
				<i>XXXX g/l</i>	<i>26</i>
				<i>X.XXX mg/l</i>	<i>27</i>
				<i>XX.XX mg/l</i>	<i>28</i>
				<i>XXX.X mg/l</i>	<i>29</i>
				<i>XXXX mg/l</i>	<i>30</i>
				<i>X.XXX µg/l</i>	<i>31</i>
				<i>XX.XX µg/l</i>	<i>32</i>
				<i>XXX.X µg/l</i>	<i>33</i>
				<i>XXXX µg/l</i>	<i>34</i>
				<i>X.XXX Curve A</i>	<i>35</i>
				<i>XX.XX Curve A</i>	<i>36</i>
				<i>XXX.X Curve A</i>	<i>37</i>
				<i>XXXX Curve A</i>	<i>38</i>
				<i>X.XXX Curve B</i>	<i>39</i>
				<i>XX.XX Curve B</i>	<i>40</i>
				<i>XXX.X Curve B</i>	<i>41</i>
				<i>XXXX Curve B</i>	<i>42</i>

Description	Register/s	Type	Access	Option	Value
<i>Secondary Reading Status</i>	<i>2005</i>	<i>Int</i>	<i>Read</i>	<i>Disabled</i>	<i>0</i>
				<i>Enabled</i>	<i>1</i>

Description	Register/s	Type	Access	Format	Units
Secondary Reading Value (Returns 0 if secondary reading is disabled)	2006	Float	Read	See register 2008	See register 2008

Description	Register/s	Type	Access	Option	Value
Secondary Reading Format and Units (Returns 0 if secondary reading is disabled)	2008	Int	Read	XX.X FTU	1
				XXX FTU	2
				XXXX FTU	3

Description	Register/s	Type	Access	Option	Value
Temperature Status	2009	Int	Read	No Sensor Present	0
				Enabled	1

Description	Register/s	Type	Access	Format	Units
Temperature Reading Value	2010	Float	Read	+/- XXX.X	See register 2012

Description	Register/s	Type	Access	Option	Value
Temperature Reading Units	2012	Int	Read	°C	0

Description	Register/s	Type	Access	Option	Value
Current Output A Status	2013	Int	Read	Disabled	0
				Enabled – Source Sensor	1
				Enabled – Source Temperature	2

Description	Register/s	Type	Access	Format	Units
Current Output A Value (Returns 0 if current output A is disabled)	2014	Float	Read	00.00 to 24.00	mA

Description	Register/s	Type	Access	Format	Units
Current Output A Percentage (Returns 0 if current output A is disabled)	2016	Int	Read	000 to 100	%

Description	Register/s	Type	Access	Option	Value
Current Output B Status	2017	Int	Read	Disabled	0
				Enabled – Source Sensor	1
				Enabled – Source Temperature	2

Description	Register/s	Type	Access	Format	Units
Current Output B Value (Returns 0 if current output B is disabled)	2018	Float	Read	00.00 to 24.00	mA

Description	Register/s	Type	Access	Format	Units
Current Output B Percentage (Returns 0 if current output B is disabled)	2020	Int	Read	000 to 100	%

Description	Register/s	Type	Access	Option	Value
Digital Output Status	2021	Int	Read	Disabled	0
				Inactive	1
				Active	2

Description	Register/s	Type	Access	Option	Value
Digital Input Status	2022	Int	Read	Disabled	0
				Inactive	1
				Active	2

Description	Register/s	Type	Access	Option	Value
Module Status	2023	Int	Read	Normal	0
				Offline	1
				Cleaning	2
				Cleaning – Recovery	3
				Digital Input – Offline	4
				Digital Input - Interlock	5
				Digital Input – Flow Switch	6
				Digital Input – Tank Level	7

Description	Register/s	Type	Access	Option	Value
Module Error Status	2024	Int	Read	No Error Present	0
				Error Present	1

Description	Register/s	Type	Access	Format	Units
Curve Units (Returns 0 if not using conversion curve)	2025	ASCII 4 Bytes	Read	7 Characters (2 Characters per Register) Each Register Read as (Upper Byte << 8 Lower Byte << 0) Unused characters return 0	N/A

Turbidity & Suspended Solids Input Setup

The Channels Setup menu contains the configuration for the sensor’s input.

The default security access code is 1000

Interface

Sensor Address To enable correct operation the sensor’s address must be entered into this menu. The address is equal to the last digit of the sensor’s serial number (note, If the last digit is 0 then the address is 10). The serial number can be found on either the body of the sensor or at either end of the sensor cable.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2101	Int	Read / Write	None	1 to 99	None

Baud Rate Set the baud rate of the RS485 sensor interface. Note, the sensor default is 9600 baud.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2101	Int	Read / Write	None	2400 baud	0	None
				4800 baud	1	None
				9600 baud	2	None
				19200 baud	3	None

Sensor

Sensor Type Displays the sensor type of the connected sensor.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2110	ASCII 3 Bytes	Read	Main Reading Status (2001) set to Sensor Present (1)	20 Characters - ASCII Codes 0x20 to 0x7E (2 Characters per Register) Each Register Read as (Upper Byte << 8 Lower Byte << 0) Unused characters set to 0	None

Sensor Scale

Set the sensor's operating scale when using Turbidity Sensor TU8325 or TU8525.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2103	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8325 or TU8525	0.000 – 4.000 NTU	1	None
				00.00 – 40.00 NTU	2	None
				000.0 – 400.0 NTU	3	None

Sensor Scale

Set the sensor's operating scale when using Suspended Solids Sensor TU8355 or TU8555.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2128	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555	00.0 – 99.9 FTU	1	None
				000 – 999 FTU	2	None
				0000 - 9999 FTU	3	None

Conversion

Enable conversion from the sensors raw measured value to an equivalent suspended solids using either the sensors built in TSS system or the module's user configurable custom curve system.

Only available when using TU8355 and TU8555.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2129	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555	Off	1	None
				TSS	2	None
				Curve A	3	None
				Curve B	4	None

TSS Unit

Set the equivalent measurement unit when using TSS mode.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2130	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to TSS (2)	%	1	None
				Ppt	2	None
				Ppm	3	None
				Ppb	4	None
				g/l	5	None
				mg/l	6	None
				µg/l	7	None

TSS Decimal Points

Set the number of decimal points used by the equivalent measurement when using TSS mode.

Register/s	Type	Access	Condition/s	Value Limits	Units
2131	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to TSS (2)	0 to 3	None

TSS Full Scale

Set the maximum value the equivalent measurement will scale to when using TSS mode.

Register/s	Type	Access	Condition/s	Value Limits	Units
2132	Float	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to TSS (2)	100 to 9999	None

TSS Factor

Sets the conversion factor from FTU to TSS to be used by the equivalent measurement when using TSS mode.

Example 1, Sensor Scale = 0 – 99.9 FTU, Sensor Reading = 45.3 FTU, TSS Units = mg/l, Decimal Points = 2.

TSS Factor	TSS Reading
0.010	0.04 g/l
0.100	0.45 g/l
1.000	4.53 g/l
5.000	22.65 g/l

Example 2, Sensor Scale = 0 – 999 FTU, Sensor Reading = 674 FTU, TSS Units = g/l, Decimal Points = 3.

TSS Factor	TSS Reading
0.010	0.006 g/l
0.100	0.067 g/l
1.000	0.674 g/l
5.000	3.370 g/l

Register/s	Type	Access	Condition/s	Value Limits	Units
2134	Float	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to TSS (2)	0.010 to 9.999	None

Setup Curve A / Setup Curve B

The module provides the user with the facility to enter a custom relationship between the incoming raw sensor measurement and the displayed value.

To use this first set the Conversion menu to either Curve A or Curve B. This Setup Curve menu will then appear.

Only available when using TU8355 and TU8555.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only			Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to Curve A (3) or Curve B (4)			

Raw Value

When enabled will calculate the raw sensor input reading in addition to the primary reading.

Only available when conversion is set to TSS or one of the curves and when using TU8355 and TU8555.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2113	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1) & Sensor Type (2110) set to either TU8355 or TU8555 & Conversion (2129) set to either TSS (2), Curve A (3) or Curve B (4)	Disabled	0	None
				Enable	1	None

Large Filter

Set the sensor's filter response time relative to signals of large variance within the limit 2 - 220s.

Register/s	Type	Access	Condition/s	Value Limits	Units
2104	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1)	2 to 220	s

Small Filter

Set the sensor's filter response time relative to signals of small variance within the limit 2 - 220s.

Register/s	Type	Access	Condition/s	Value Limits	Units
2105	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1)	2 to 220	s

Checking

Enabled

Enables the check signal, allowing the checking of dry or fouled sensors.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2106	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1)	Off	0	None
				On	1	None

Fouling

Set the fouling alarm level as a percentage of the check signal, in the of range 0 - 100%.

Register/s	Type	Access	Condition/s	Value Limits	Units
2108	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1)	0 to 100	%

Dry

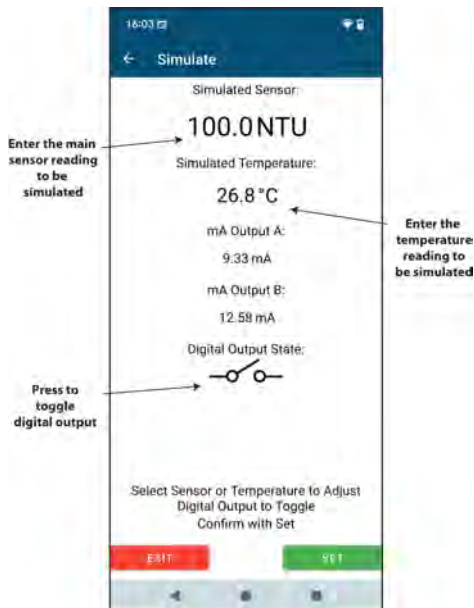
Set the dry alarm level as a percentage of the check signal, in the of range 100 - 200%.

Register/s	Type	Access	Condition/s	Value Limits	Units
2109	Int	Read / Write	Main Reading Status (2001) set to Sensor Present (1)	100 to 200	%

Simulate**Sensors**

Assists the user in commissioning the module by simulating the main sensor and temperature readings which in turn drive the current outputs as per their configuration. User can also toggle the status of the digital output.

Available options depend on current output and digital output configurations.



Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Setup Custom Curve

Number of Points

Number of points – Define the number of data entry points which make up the custom curve (not including the zero point as the unit will always assume that the concentration zero is equal to the FTU reading zero).

Register/s	Type	Access	Condition/s	Value Limits	Units
Curve A: 3120 Curve B: 3220	Int	Read / Write	None	1 - 9	None

Units

Enter the units the conversion will use (7 Characters maximum).

Register/s	Type	Access	Condition/s	Value Limits	Units
Curve A: 3122 Curve B: 3222	4 Byte ASCII	Read / Write	None	7 Characters - ASCII Codes 0x20 to 0x7E (2 Characters per Register) Each Register Read as (Upper Byte << 8 Lower Byte << 0) Unused characters set to 0	None

Curve Range

Enter the range over which the converted reading will operate.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
Curve A: 3126 Curve B: 3226	Int	Read / Write	None	000.0 to 9.999	0	None
				0.000 to 99.99	1	
				00.00 to 999.9	2	
				000.0 to 9999	3	

Point Raw Value

Enter the raw FTU value for each point of the custom concentration curve.

Register/s		Type	Access	Condition/s	Value Limits & Units
Curve A	Curve B	Float	Read / Write	None	As per Scale (2128)
Point 1: 3130	Point 1: 3230				
Point 2: 3134	Point 2: 3234				
Point 3: 3138	Point 3: 3238				
Point 4: 3142	Point 4: 3242				
Point 5: 3146	Point 5: 3246				
Point 6: 3150	Point 6: 3250				
Point 7: 3154	Point 7: 3254				
Point 8: 3158	Point 8: 3258				
Point 9: 3162	Point 9: 3262				

Point Reading

Enter the equivalent concentration value for each point of the custom concentration curve.

Register/s		Type	Access	Condition/s	Value Limits & Units
Curve A	Curve B	Float	Read / Write	None	As per Curve Range (Curve A: 3126 Curve B: 3226) & Units (Curve A: 3122 Curve B: 3222)
Point 1: 3132	Point 1: 3232				
Point 2: 3136	Point 2: 3236				
Point 3: 3140	Point 3: 3240				
Point 4: 3144	Point 4: 3244				
Point 5: 3148	Point 5: 3248				
Point 6: 3152	Point 6: 3252				
Point 7: 3156	Point 7: 3256				
Point 8: 3160	Point 8: 3260				
Point 9: 3164	Point 9: 3264				

Calibration

Calibration Procedures

The sensor is supplied with a factory calibration of the zero and span done with known standard solutions.

Checking and periodic calibration of the sensor is always necessary to ensure the accuracy of the measurement. The optical components can have small drifts during the life. The cleanliness of the optical lens is an important element to check before making a new calibration. If necessary, clean them with a soft cloth.

It is suggested to run the zero calibration before the span calibration.

Calibration Menu

The calibration menu provides the facility to adjust the sensor inputs to the system in which it is operating.

The default security access code is 1000

Module

Mode

Selecting off-line causes any current outputs to go to the value stated in their "Offline Mode" menu, useful for when commissioning or calibrating the module.

When the unit is placed in an off-line state "off-line" will appear in the messages section on the measurement screen.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2201	Int	Read/ Write	None	Online	0	None
				Offline	1	None

Sensor

Initiate Zero Calibration

Enter the sensor zero calibration routine.

See Zero Calibration on page 39 for further information.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Zero Value

Displays the currently used calculated zero calibration value.

Cannot be edited.

Register/s	Type	Access	Condition/s	Value Limits	Units
2202	Float	Read	Sensor Type (2110) set to either TU8325 or TU8525	As per Sensor Scale (2103)	NTU
			Sensor Type (2110) set to either TU8355 or TU8555	As per Sensor Scale (2123)	FTU

Span Value Scale

Sets the scale used by the span calibration point value. Available options will depend on sensor being used.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2204	Int	Read/Write	None	000.0 – 400.0 NTU	1	Sensor Type (2110) set to either TU8325 or TU8525
				000.0 – 40.00 NTU	2	Sensor Type (2110) set to either TU8325 or TU8525
				000.0 – 4.000 NTU	3	Sensor Type (2110) set to either TU8325 or TU8525
				0000 – 9999 FTU	0	Sensor Type (2110) set to either TU8325 or TU8525
				000.0 – 999.9 FTU	1	Sensor Type (2110) set to either TU8325 or TU8525

Initiate Span Calibration

Enter the sensor span calibration routine.

See Span Calibration on page 41 for further information.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Span Value

Displays the currently used calculated span calibration value.

Cannot be edited.

Register/s	Type	Access	Condition/s	Value Limits	Units
2205	Float	Read	None	XXX.X	%

Last Calibration Date Displays the last calibration date when either zero or span calibration was performed. Note that this menu cannot be edited.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2207	Int	Read	None	1 to 31	Day
Register/s	Type	Access	Condition/s	Value Limits	Units
2208	Int	Read	None	1 to 12	Month
Register/s	Type	Access	Condition/s	Value Limits	Units
2209	Int	Read	None	2000 to 3000	Year

Reminder

Set By enabling the calibration reminder, the user can configure a calibration interval, which when expired will activate an alarm and message on the measurement screen.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2210	Int	Read / Write	None	No	0	None
				Yes	1	None

Interval					
Sets the interval time for the calibration alarm.					
The Reminder Date will update to show the date of the next calibration alarm.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2211	Int	Read / Write	Reminder Set (22120 set to Yes (1))	1 to 999	Days

Date					
Sets the exact date of the next calibration alarm.					
The Calibration Interval will update to show the number of days to the next calibration date.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2212	Int	Read / Write	Reminder Set (22120 set to Yes (1))	1 to 31	Day

Register/s	Type	Access	Condition/s	Value Limits	Units
2213	Int	Read / Write	Reminder Set (22120 set to Yes (1))	1 to 12	Month
Register/s	Type	Access	Condition/s	Value Limits	Units
2214	Int	Read / Write	Reminder Set (22120 set to Yes (1))	2000 to 3000	Year

Defer Calibration Date

Turns off the alarm and increases the calibration interval by an extra 7 days.

Only appears once the calibration interval has expired.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2215	Int	Read / Write	Calibration Due Set (3208 Bit 2 = 1)	Done	0	None
				Defer	1	None

Reset

Reset Zero Calibration

Reset any sensor zero calibration that may have been performed.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2216	Int	Read / Write	None	Done	0	None
				Reset	1	None

Reset Span Calibration

Reset any sensor span calibration that may have been performed.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2217	Int	Read / Write	None	Done	0	None
				Reset	1	None

Zero Calibration

The zero calibration must be performed in the zero standard solution or in water with known turbidity value next to zero.

Enter the known solution's value in the Zero Calibration Point menu and then with the sensor immersed in the solution use the Sensor Zero Calibration menu to commence with the calibration.

Once complete the calibration result is displayed. If it has failed inspect the condition of the surface of the lenses and if necessary, clean the surface with a cloth. Also check that the sensor is immersed in the standard solution. In the case of a calibration fail the sensor will use the existing zero calibration value.

Note, the zero calibration will also fail if the calculated offset is greater than ± 0.400 NTU for TU8325 or TU8525 sensors and ± 10 FTU for TU8355 or TU8555 sensors.

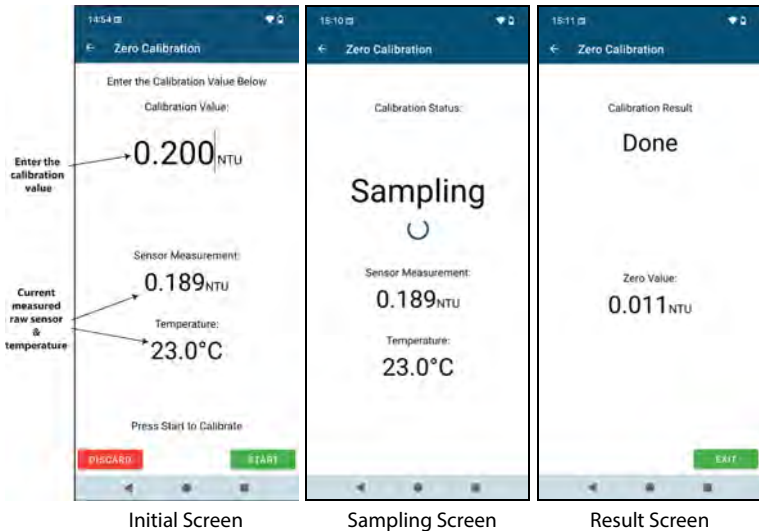
The zero calibration is performed on all the scales at once.

Calibration method using App

To enter the zero calibration menu, click on Initiate Zero Calibration, Calibrate, then place the sensor in water with known turbidity value next to zero. In the available Calibration Value field enter the known turbidity value.

Using the displayed measurements wait for the readings to stabilise. Once stable press the start button and the module will begin to sample the sensor.

Once complete the app will display Done along with the newly calculated zero offset calibration value. Note, if the calculated offset value is greater than ± 0.400 NTU for TU8325 or TU8525 sensors and ± 10 FTU for TU8355 or TU8555 sensors the app will display Fail, and the zero offset value will not be updated.



Calibration method using Modbus

To begin the calibration process set the *Zero Calibration Status (2340)* to *Calibration Mode (1)*, then place the sensor in water with known turbidity value next to zero. Write the known turbidity value to *Zero Calibration Value (2341)*.

Using either the *Main Reading Value (2002)* or *Secondary Reading Value (2006)* if using conversion, wait for the reading to stabilise. Once stable set *Zero Calibration Status (2340)* to *Begin Zero Calibration (2)* to begin sampling the sensor.

Once completed *Zero Calibration Status (2340)* will automatically change to *Calibration Process Completed (3)* and the newly calculated zero offset value can be read from *Zero Value (2202)*. Note, if the calculated offset value is greater than ± 0.400 NTU for TU8325 or TU8525 sensors and ± 10 FTU for TU8355 or TU8555 *Zero Calibration Status (2340)* will automatically change to *Calibration Process Failed (4)* and the zero offset value will not be updated.

Zero Calibration Status						
Controls the sensor zero calibration process.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2340	Int	Read / Write	None	Calibration Stopped	0	None
				Set Module to Calibration Mode	1	None
				Begin Zero Calibration	2	None
				Calibration Process Completed	3	None
				Calibration Process Failed	4	None

Zero Calibration Value						
The know turbidity value of the solution the sensor is currently in.						
Register/s	Type	Access	Condition/s	Value Limits	Units	
2341	Float	Write	Sensor Type (2110) set to either TU8325 or TU8525	0.000 to 4.000	NTU	
			Sensor Type (2110) set to either TU8355 or TU8555	0.0 to 100.0	FTU	

Span Calibration

The span calibration can be done in either a Formazine solution or in a known turbidity value solution.

Set the scale the span calibration is to be conducted over using the Span Scale menu, then enter the known solution's value using the Span Calibration Point. Place the sensor in the solution and use the Sensor Span Calibration menu to calibrate the sensor.

Once complete the calibration result is displayed. If it has failed inspect the condition of the surface of the lenses and if necessary, clean the surface with a cloth. Also check that the sensor is immersed in the standard solution. In the case of a calibration fail the sensor will use the existing span calibration value.

Note, the span calibration will also fail if the calculated slope is outside 70 to 130%.

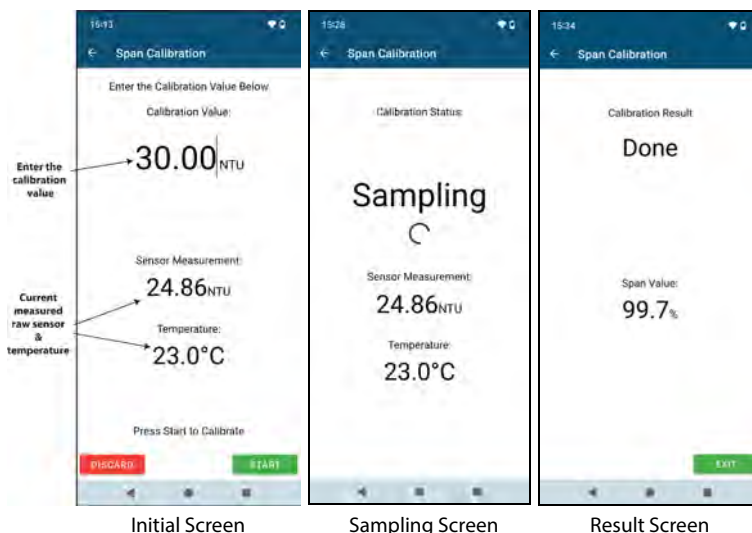
When performing a span calibration it is recommended to not use values lower than 2 NTU for TU8325 or TU8525 sensors or 50 FTU when using TU8355 or TU8555 sensors.

Calibration method using App

To enter the span calibration menu, click on Initiate Span Calibration, Calibrate, then place the sensor in a solution with known turbidity value. In the available Calibration Value field enter the known turbidity value.

Using the displayed measurements wait for the readings to stabilise. Once stable press the start button and the module will begin to sample the sensor.

Once complete the app will display Done along with the newly calculated slope calibration value. Note, if the calculated slope value is outside 70 to 130%. the app will display Fail, and the slope value will not be updated.



Calibration method using Modbus

To begin the calibration process set the *Span Calibration Status (2350)* to *Calibration Mode (1)*, then place the sensor in a solution with a known turbidity value. Write the known turbidity value to *Span Calibration Value (2351)*.

Using either the *Main Reading Value (2002)* or *Secondary Reading Value (2006)* if using conversion, wait for the reading to stabilise. Once stable set *Span Calibration Status (2350)* to *Begin Span Calibration (2)* to begin sampling the sensor.

Once completed *Span Calibration Status (2350)* will automatically change to *Calibration Process Completed (3)* and the newly calculated span value can be read from *Span Value (2205)*. Note, if the calculated slope value is outside 70 to 130% *Span Calibration Status (2350)* will automatically change to *Calibration Process Failed (4)* and the span slope value will not be updated.

Span Calibration Status						
Controls the sensor span calibration process.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2350	Int	Read / Write	None	Calibration Stopped	0	None
				Set Module to Calibration Mode	1	None
				Begin Span Calibration	2	None
				Calibration Process Completed	3	None
				Calibration Process Failed	4	None

Span Calibration Value					
The know turbidity value of the solution the sensor is currently in.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2351	Float	Write	Sensor Type (2110) set to either TU8325 or TU8525	As per Span Value Scale (2204)	NTU
			Sensor Type (2110) set to either TU8355 or TU8555	As per Span Value Scale (2204)	FTU

Digital Output

The DTU18 is equipped with a single volt free, single pole, single throw, normally open relay, which can be used to activate external sensor cleaning equipment or to indicate the module alarm status.

Operation

Mode Select the operation mode of the Digital Output.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2401	Int	Read / Write	None	Disabled	0	None
				Alarm	1	None
				Cleaning	2	None

Polarity Configure whether the digital output opens or closes when active.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2402	Int	Read / Write	Mode (2401) not set to Disabled (0)	Normally Open	0	None
				Normally Closed	1	None

Alarm

Source The digital output will energise when one of the following sources are active. • Sensor Error– When a sensor related error is detected. • Calibration – When a calibration is in progress. • Offline – When the module is taken offline. • Any Error – When any error is detected.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2403	Int	Read / Write	Mode (2401) set to Alarm (1)	Sensor Error	0	None
				Calibration Mode	1	None
				Offline Mode	2	None
				Any Error	3	None

Clean

The digital output can be configured to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Its purpose is to prevent accumulation of particulate matter on the active surfaces of the probe. Note when cleaning is active the input will be taken offline, this will prevent any undesired control actions resulting from spraying cleaning solution onto the probe.

Duration

Enter the duration of the cleaning operation. 00:01 to 60:00 (mm:ss)

Register/s	Type	Access	Condition/s	Value Limits	Units
2404	Int	Read / Write	Mode (2401) set to Cleaning (2)	0 to 60	Minutes
2405				0 to 60	Seconds

Recovery

The user can introduce an additional post cleaning delay before coming back "On-line", this provides the probe a period to stabilise after the cleaning has finished. 00:00 to 60:00 (mm:ss)

Register/s	Type	Access	Condition/s	Value Limits	Units
2406	Int	Read / Write	Mode (2401) set to Cleaning (2)	0 to 60	Minutes
2407				0 to 60	Seconds

Interval

Enter the time between cleaning operations. 00:01 to 96:00 (hh:mm)

Register/s	Type	Access	Condition/s	Value Limits	Units
2408	Int	Read / Write	Mode (2401) set to Cleaning (2)	0 to 96	Hours
2409				0 to 60	Minutes

Manual Clean

Manually start the clean cycle.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2410	Int	Read / Write	Mode (2401) set to Cleaning (2)	Done	0	None
				Begin	1	None

mA Outputs

The DTU18 is fitted with two current outputs, either which can be used for the transmission of the primary variable or temperature. The current output menu contains all the necessary setup functions to configure the current output sources. The app will display the status of the current output on the measurement screen, where --mA indicates that the output is disabled.

Output

Mode						
Enable the current output by selecting its output mode, either 0 – 20mA or 4 – 20mA.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2501 B:2601	Int	Read / Write	None	Disabled	0	None
				0 – 20mA	1	None
				4 – 20mA	2	None

Source						
Select the source for the current output. Note, the temperature option is only available if the Temperature Input option in the Channel Menu is set to either PT1000 or PT100.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2502 B:2602	Int	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	Sensor	0	None
				Temperature	1	None

Scaling

Zero (0mA)						
Enter the desired sensor value to be represented by 0mA (depends on current output mode). An inverse relationship can be achieved by setting the Zero greater than the Span.						
If the sensor reading falls outside this or the span value an error will be activated.						
Register/s	Type	Access	Condition/s	Value Limits & Units		
A:2503 B:2603	Float	Read / Write	Output Mode (A:2501, B:2601) set to 0 – 20mA (1)	If Source (A:2502, B:2602) set to Sensor (0)	As per register 2004	
				If Source (A:2502, B:2602) set to Temperature (1)	0.0 to 50.0°C	

Zero (4mA)

Enter the desired sensor value to be represented by 4mA (depends on current output mode). An inverse relationship can be achieved by setting the Zero greater than the Span.

If the sensor reading falls outside this or the span value an error will be activated.

Register/s	Type	Access	Condition/s	Value Limits & Units	
A:2505 B:2605	Float	Read / Write	Output Mode (A:2501, B:2601) set to 4 – 20mA (2)	If Source (A:2502, B:2602) set to Sensor (0)	As per register 2004
				If Source (A:2502, B:2602) set to Temperature (1)	0.0 to 50.0°C

Span (20mA)

Enter the desired sensor value to be represented by 20mA. An inverse relationship can be achieved by setting the Span less than the Zero.

If the sensor reading falls outside this or the zero value an error will be activated.

Register/s	Type	Access	Condition/s	Value Limits & Units	
A:2507 B:2607	Float	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	If Source (A:2502, B:2602) set to Sensor (0)	As per register 2004
				If Source (A:2502, B:2602) set to Temperature (1)	0.0 to 50.0°C

Action

On Error

The current outputs can be programmed to output 0mA, 4mA, 22mA or hold their value when an error is detected on the input source (i.e. Sensor Fault, Temperature Fault), to provide remote warning of error conditions or to ensure fail safe operation.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2509 B:2609	Int	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	No Action	0	None
				Drive to 0mA	1	None
				Drive to 4mA	2	None
				Drive to 22mA	3	None
				Hold Level	4	None

Offline Mode						
The current outputs can be programmed to output 0mA, 4mA, 22mA or hold their value when the module is put in an offline state.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2510 B:2610	Int	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	No Action	0	None
				Drive to 0mA	1	None
				Drive to 4mA	2	None
				Drive to 22mA	3	None
				Hold Level	4	None

Calibrate

Output

Permits the user to adjust the current output, to calibrate any equipment that may be being used to monitor the current output signal.

App Method

On entering the calibration function module will set the current output to a fixed value as per shown in the calibration menu. Enter the value as measured by the external meter in the displayed field then press next to proceed to the next point.

Repeat as before until both points have been calibrated. Next proceed to the check section where the current output will be set to a mid-point between to allow for calibration verification.

If the calibration is successful select Save, else select Restart to repeat the calibration or Discard to exit.

Modbus Method

4-20mA Mode Example

Set Current Output Calibration Status register (A:2530, B:2630) to 2 (Start 4mA Calibration), then write the measured current output value to the Calibration 4mA Value register (A:2533, B2633).

Next set the Current Output Calibration Status register to 3 (Start 20mA Calibration), then write the measured current output value to the Calibration 20mA Value register (A:2535, B2635).

Next set the Current Output Calibration Status register to 5 (Check Calibration 12mA). If satisfied with the calibration check value set the Current Output Calibration Status register to 6, else set the register to 0.

0-20mA Mode Example

Follow the above example but use Start 0mA Calibration state (1), instead of Start 4mA Calibration state (2), Calibration 0mA Value register (A:2531, B2631) instead of Calibration 4mA Value register and Check Calibration 10mA state (4) instead of Check Calibration 12mA state (5).

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2530 B:2630	Int	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	Stop Calibration	0	None
				Start 0mA Calibration	1	Output Mode (A:2501, B:2601) set to 0 – 20mA (1)
				Start 4mA Calibration	2	Output Mode (A:2501, B:2601) set to 4 – 20mA (2)
				Start 20mA Calibration	3	None
				Check Calibration 10mA	4	Output Mode (A:2501, B:2601) set to 0 – 20mA (1)
				Check Calibration 12mA	5	Output Mode (A:2501, B:2601) set to 4 – 20mA (2)
				Save Calibration	6	None

Calibration 0mA Value					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:2531 B:2631	Float	Write	Output Mode (A:2501, B:2601) set to 0 – 20mA (1)	0.000 to 2.000	mA
Calibration 4mA Value					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:2533 B:2633	Float	Write	Output Mode (A:2501, B:2601) set to 4 – 20mA (2)	2.000 to 6.000	mA
Calibration 20mA Value					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:2535 B:2635	Float	Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	18.000 to 22.000	mA

Reset						
Used to reset any user calibration applied to the 0/4-20mA Current Output						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:2511 B:2611	Int	Read / Write	Output Mode (A:2501, B:2601) Not set to Disabled (0)	Done	0	None
				Reset Calibration (Clears to 0 once complete)	1	None

Digital Input

The DTU18 is fitted with a single digital input. The digital input menu contains all the necessary setup functions to configure the digital input sources. This input is intended to be switched using a volt free link, switch or relay. The user can select whether closing or opening the contact initiates the configured action.

Operation

Function

The digital input can be configured to operate in the following ways:

- ❖ Offline
- ❖ Interlock
- ❖ Flow Switch
- ❖ Tank Level
- ❖ Switch Setup
- ❖ Cleaning

Offline, Interlock, Flow Switch and Tank Level – When active will take the module “offline”. This causes any digital outputs to de-energise, the 0/4-20mA output to change to its set offline state and the selected function message to appear on the measurement screen.

Switch Setup – When active the module will load the configuration that has been stored in one of the two internal save stores. The original configuration is restored upon the digital input going inactive.

Cleaning – Manually move the digital output cleaning cycle to the clean phase of the cycle.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2701	Int	Read / Write	None	Disabled	0	None
				Offline	1	None
				Interlock	2	None
				Flow Switch	3	None
				Tank Level	4	None
				Switch Setup	5	Save Store A Present (3102 = 1) or Save Store B Present (3111 = 1)
				Cleaning	6	Digital Output Mode (2401) set to cleaning (2)

Store

Select which store to load when using Switch Setup.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2702	Int	Read / Write	Function (2701) set to Switch Setup (5)	Store A	0	Save Store A Present (3102 = 1)
				Store B	1	Save Store B Present (3111 = 1)

Polarity

Configure whether the digital input activates on the closing of circuit (normal) or the opening of the circuit (reverse).

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2703	Int	Read / Write	Function (2701) not set to Disabled (0)	Normally Open	0	None
				Normally Closed	1	None

Configuration

The configuration menu enables the user to configure the basic operating parameters of the module.

Time & Date

Current

The module's current internal Time and Date.

Hour

Register/s	Type	Access	Condition/s	Value Limits	Units
2801	Int	Read / Write	None	0-23	Hour

Minute

Register/s	Type	Access	Condition/s	Value Limits	Units
2802	Int	Read / Write	None	0-59	Minute

Day

Register/s	Type	Access	Condition/s	Value Limits	Units
2803	Int	Read / Write	None	1-31	Day

Month

Register/s	Type	Access	Condition/s	Value Limits	Units
2804	Int	Read / Write	None	1-12	Month

Year

Register/s	Type	Access	Condition/s	Value Limits	Units
2805	Int	Read / Write	None	2000-3000	Year

Update

Set the module's time as to the time on the device running the app.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Security Code

Change Code

Sets the security access code used by the LTH Discover app to prohibit changes to the module's configuration by unauthorised personnel.

Note, if set to 0000 the security code is permanently disabled unless changed back to another number.

Register/s	Type	Access	Condition/s	Value Limits	
App Only					

Hardware

User Label

Set's the module's user label as displayed instead of the serial number in the Bluetooth discovery screen and measurement screen.

Note, leave blank to revert back to using the module's serial number.

Register/s	Type	Access	Condition/s	Value Limits	Units
2807	ASCII 4 Bytes	Read / Write	None	8 Characters - ASCII Codes 0x20 to 0x7E (2 Characters per Register) Each Register Read as (Upper Byte << 8 Lower Byte << 0) Unused characters set to 0	None

Model

The module's model Type

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2812	Int	Read	None	DTU18	5	None

Serial Number

The module's Serial Number

Register/s	Type	Access	Condition/s	Value Limits	Units
2813	Long	Read	None	8 Digits	None

MAC Address

The module's Ethernet port MAC Address

Hexadecimal format with each register holding 4 digits,
Register read as (Upper Byte << 8 | Lower Byte << 0)

Register/s	Type	Access	Condition/s	Value Limits	Units
2815	3 Byte Hex	Read	None	XX-XX-XX-XX-XX-XX	None

Unlock

Modbus

The DXU18 series features optional functions which when purchased will expand the module's capabilities. By default, the Modbus function of the DXU18 is locked. It can be unlocked by LTH or your local distributor at the time of order.

Alternatively, the Modbus function may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module and the required function to be unlocked.

Register/s	Type	Access	Condition/s	Value Limits	Units
App Only					

Firmware

Module Firmware Version

The module's main firmware version number.

Register/s	Type	Access	Condition/s	Value Limits	Units
2821	Long	Read	None	Format: AA.BB.CC Read as: AA << 16 BB << 8 CC << 0	None

Measurement Firmware Version

The module's measurement section firmware version number.

Register/s	Type	Access	Condition/s	Value Limits	Units
2823	Long	Read	None	Format: AA.BB.CC Read as: AA << 16 BB << 8 CC << 0	None

Configuration

Bluetooth Firmware Version The module's Bluetooth section firmware version number.					
Register/s	Type	Access	Condition/s	Value Limits	Units
2825	Long	Read	None	Format: AA.BB.CC Read as: AA << 16 BB << 8 CC << 0	None

Update Module Firmware Update the Module's main firmware. When selected the app gives the user the option of using either the firmware bundled with the LTH Discover app or alternatively using a different version of firmware that LTH may have provided separately by browsing to the firmware "*.bin" file location on the phone. Note, when using iOS, the file must be located in the LTH Discover folder as found in the On My iPhone folder. Note, Updating the firmware may take up to 5 minutes to complete, during which the device uploading the firmware must remain connected to the module via Bluetooth by staying within range of the module and with the LTH Discover app open.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Modbus

The DTU18 features an optional Modbus interface via either RTU or ASCII over RS-485 or RCP/IP over Ethernet. Using the interface the module's measurements can be read, status checked, configurations changed, and calibrations performed.

Note, by default the Modbus functionality is locked, and requires an additional purchase to unlock. This can be done at the time of ordering the module or alternatively may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module.

Supported Modbus Function Codes

Function Code	Type	Function
3	Read Holding Register	Reads one or more registers. 1 to a maximum of 125 consecutive registers (1 register = 2 bytes) can be read with a telegram.
6	Write Single Register	Write a single register with a new value. ! Note. Registers whose address space consume more than one register i.e. Floats, cannot be set using this function code.
16	Write Multiple Registers	Writes several registers with a new value. A maximum of 120 consecutive registers can be written with a single telegram.

! Maximum number of writes - If a non-volatile parameter is modified via the Modbus this change is saved in the internal module storage. The number of writes to the storage is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and module failure. For this reason, avoid constantly writing module parameters via the Modbus.

Response Times - The time it takes the module to respond to a request telegram from the Modbus master is typically 25 to 50 milliseconds. It may take longer for a command to be executed in the module. Thus, the data is not updated until the command has been executed. Write commands especially are affected by this.

Data types - the following data types are supported by the module:

• **FLOAT** – Floating point numbers IEE 754, Data length 4 bytes (2 registers)

Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM

S = Sign, E = Exponent, M = Mantissa

• **INT** – Integer (16 bits), Data length 2 bytes (1 register)

Byte 1	Byte 0
Most Significant Bit (MSB)	Least Significant Bit (LSB)

• **LONG** – Long Integer (32 bits), Data length 4 bytes (2 registers)

Byte 3	Byte 2	Byte 1	Byte 0
Most Significant Bit (MSB)	...	...	Least Significant Bit (LSB)

Byte Transmission Sequence – The bytes are transmitted in the following data order:

Type	Sequence			
	1 st	2 nd	3 rd	4 th
FLOAT (Big Endian)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
INT	Byte 1 (MSB)	Byte 0 (LSB)		
LONG (Big Endian)	Byte 3 (MSB)	Byte 2	Byte 1	Byte 0 (LSB)

Operation

Mode

Set the operation mode of the Modbus interface, note the RS485 and Ethernet interfaces cannot both be used at the same time.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2901	Int	Read / Write	None	Disabled	0	None
				RS485 RTU	1	None
				RS485 ASCII	2	None
				Ethernet TCP/IP	3	None

Slave Address

Set the slave address of the Module when using the RS485 interface.

Register/s	Type	Access	Condition/s	Value Limits	Units
2902	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	1-255	None

Interface

Baud Rate

Set the RS485 interface baud rate.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2903	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	300	0	None
				600	1	None
				1200	2	None
				2400	3	None
				4800	4	None

				9600	5	None
				19200	6	None
				31250	7	None
				38400	8	None

Parity

Set the parity format of the RS485 interface.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2904	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	None	0	None
				Odd	1	None
				Even	2	None

Stop Bits

Set the number of stop bits used by the RS485 interface.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2905	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	1	0	None
				2	1	None

Use DHCP

If available on the connected network use the DHCP server to automatically configure the TCP/IP interface. Note, if required the module's MAC address can be found in the configuration menu.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2906	Int	Read / Write	Mode (2901) set to Ethernet TCP/IP (3)	No	0	None
				Yes	1	None

TCP/IP Address

If not using DHCP, specify the Module's own TCP/IP address.

If using DHCP this menu will display the DHCP assigned Gateway Address.

Register/s	Type	Access	Condition/s	Value Limits	Units
2907 (DHCP Disabled)	Long	Read / Write	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)	Format: AAA.BBB.CCC.DDD Equal to:	None

2909 (DHCP Enabled)		Read	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)	AAA << 0 BBB << 8 CCC << 16 DDD << 24 Each element 0-255	
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Gateway Address

If not using DHCP, specify the Gateway Address on the IP network the module is connected to. Note, if no Gateway is present the Address can be set to 0.0.0.0.

If using DHCP this menu will display the DHCP assigned Gateway Address.

Register/s	Type	Access	Condition/s	Value Limits	Units
2911 (DHCP Disabled)	Long	Read / Write	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)	Format: AAA.BBB.CCC.DDD Equal to: AAA << 0 BBB << 8 CCC << 16 DDD << 24 Each element 0-255	None
2913 (DHCP Enabled)		Read	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)		

Subnet Mask

If not using DHCP, specify the Subnet Mask of the IP network the module is connected to.

If using DHCP this menu will display the DHCP assigned Subnet Mask.

Register/s	Type	Access	Condition/s	Value Limits	Units
2915 (DHCP Disabled)	Long	Read / Write	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)	Format: AAA.BBB.CCC.DDD Equal to: AAA << 0 BBB << 8 CCC << 16 DDD << 24 Each element 0-255	None
2917 (DHCP Enabled)		Read	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)		

Port Number

Specify the TCP port the Modbus communication utilises.

Unless already in use by a different process, recommend leaving as the Modbus standard port of 502.

Register/s	Type	Access	Condition/s	Value Limits	Units
2919	Int	Read / Write	Mode (2901) set to Ethernet TCP/IP (3)	1-65535	None

Save, Restore & Reset

The DTU18 features the ability to save and restore the current configuration of the module to one of two stores "A and B". In addition, using the LTH Discover app the user can save the configuration of the module to the phone which can then be used to setup additional modules or emailed to LTH or your local distributor to help with support issues.

The save and restore menu also features the ability to reset the whole module back to its factory settings.

Stores

Save

Save the configuration of the module to one of the internal module stores A or B.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:3101 B:3110	Int	Read / Write	None	Done	0	None
				Perform Save	1	None
				Note, returns to 0 once complete		

Save Present

Indicates if either of the internal module stores A or B has an existing save stored in them.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:3102 B:3111	Int	Read	None	No save present	0	None
				Save Present	1	None

Store Time and Date

The time and date of the internal module store. Returns 0 if no store present.

Hour

Register/s	Type	Access	Condition/s	Value Limits	Units
A:3103 B:3112	Int	Read	None	0-23	Hour

Minute

Register/s	Type	Access	Condition/s	Value Limits	Units
A:3104 B:3113	Int	Read	None	0-59	Minute

Day					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:3105 B:3114	Int	Read	None	1-31	Day
Month					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:3106 B:3115	Int	Read	None	1-12	Month
Year					
Register/s	Type	Access	Condition/s	Value Limits	Units
A:3107 B:3116	Int	Read	None	2000-3000	Year

Restore

Restore the module configuration from one of the internal module stores.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:3108 B:3117	Int	Read	None	Done	0	None
				Perform Restore	1	None
				Note, returns to 0 once complete		

Delete

Delete the module configuration from one of the internal module stores.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A:3109 B:3118	Int	Read	None	Done	0	None
				Perform Delete	1	None
				Note, returns to 0 once complete		

Phone – Upload to Module

Upload a module configuration saved as a .json file from the phone to the module.

Note, when using iOS, the file must be located in the *LTH Discover* folder as found in the *On My iPhone* folder.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Phone – Download from Module

Download the module configuration as a .json file from the module to the phone.

Note, when using iOS, the downloaded file will be located in the *LTH Discover* folder as found in the *On My iPhone* folder.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Default

Module

Reset the module to back to its factory settings.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3100	Int	Read / Write	None	Done	0	None
				Perform Reset <i>Note, returns to 0 once complete</i>	1	None

Errors

The DTU18 features an extensive error system that constantly monitors the condition of the base module, the sensor inputs, and the current outputs. When an error occurs, the module will indicate via the status LED on the enclosure front. Additionally, if configured the current outputs will change to their error state, and the digital output will energise.

When using the *LTH Discover* app, a full break down of currently active errors can be seen in the Error menu which is accessible via the main menu or by clicking on the error icon, if present, in the top left of the measurement screen. Whilst in the error menu, clicking on any of the active errors brings up a detailed description of the error and suggested remedies for the issue.

Additional guidance to fixing faults can be found in the Fault Finding section from page 71.

Module Errors

E01: Read/Write Error Try switching the module off and then on again. If the message persists, consult with your supplier, as this module may require to be returned for repair.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3200 Bit 1	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E02: Data Error The module configuration has for some reason become corrupted. Try switching the module off and then on again. If the message persists use the Default Module function in the Save/Restore menu or consult with your supplier, as this module may require to be returned for repair.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3200 Bit 2	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E03: Storage Error The save setup configuration has for some reason become corrupted. Try switching the module off and then on again. If the message persists use the delete setup function in the Save/Restore menu or consult with your supplier, as this module may require to be returned for repair.						
Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3200 Bit 3	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E04: Factory Error

The factory configuration has for some reason become corrupted. Try switching the module off and then on again. If the message persists, consult with your supplier, as this module may require to be returned for repair.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3200 Bit 4	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E05: User Cal Error

The module's user calibration has for some reason become corrupted. Try switching the module off and then on again. If the message persists use the Default module function in the Save/Restore menu or consult with your supplier, as this module may require to be returned for repair.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3200 Bit 5	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

Sensor Input Errors

E25: Sensor Communication Error

Either no sensor is connected, or the connected sensor is not communicating correctly. Check sensor address and baud rate in the channel menu. Check sensor has been connected correctly. If the message persists, please consult with your supplier.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3202 Bit 5	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E26: Fouling Error

Check sensor face for fouling and clean if required. If the message persists, please consult with your supplier.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
3202 Bit 6	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E27: Dry Cell Error

The sensor is no longer immersed in liquid. Check sensor installation. If the message persists, please consult with your supplier.

<i>Register/s</i>	<i>Type</i>	<i>Access</i>	<i>Condition/s</i>	<i>Option</i>	<i>Value</i>	<i>Condition/s</i>
3202 Bit 7	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E28: High External Light Error

The sensor is being affected by an external light source. Please ensure that the sensor is shielded from other light sources. If the message persists, please consult with your supplier.

<i>Register/s</i>	<i>Type</i>	<i>Access</i>	<i>Condition/s</i>	<i>Option</i>	<i>Value</i>	<i>Condition/s</i>
3202 Bit 8	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E29: Indeterm. Measure Error

There is a sensor measurement error. Try switching the module off and then on again. Check the sensor for any damage. If the message persists, consult with your supplier.

<i>Register/s</i>	<i>Type</i>	<i>Access</i>	<i>Condition/s</i>	<i>Option</i>	<i>Value</i>	<i>Condition/s</i>
3202 Bit 5	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

Current Output Errors

E61: Output A Hardware**E71: Output B Hardware**

The current output circuit has detected an error in the current output loop; this is most commonly due to either a broken loop or too large a load resistor.

<i>Register/s</i>	<i>Type</i>	<i>Access</i>	<i>Condition/s</i>	<i>Option</i>	<i>Value</i>	<i>Condition/s</i>
A: 3206 Bit 1 B: 3207 Bit 1	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E62: Source < Output A Zero
E72: Source < Output B Zero

The source's input level is less than that set for the current output zero.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3206 Bit 2 B: 3207 Bit 2	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E63: Source > Output A Span
E73: Source > Output B Span

The source's input level is greater than that set for the current output span.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3206 Bit 3 B: 3207 Bit 3	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E64: Source > Output A Zero
E74: Source > Output B Zero

The source's input level is greater than that set for the current output zero.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3206 Bit 4 B: 3207 Bit 4	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

E65: Source < Output A Span
E75: Source < Output B Span

The source's input level is less than that set for the current output span.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3206 Bit 5 B: 3207 Bit 5	Int	Read	None	Error Not Present	0	None
				Error Present	1	None

Service Messages

M81: Service Due

The Planned Service interval for this module has expired. Please contact LTH Electronics at the details below:

LTH Electronics Ltd
Chaul End Lane, Luton, Beds
LU4 8EZ
Tel. 0044 (0) 1582 593693, Email: sales@lth.co.uk

NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3208 Bit 1	Int	Read	None	Message Not Present	0	None
				Message Present	1	None

M82: Calibration Due

The time since the last calibration was performed has exceeded the time set in the calibration menu.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
A: 3208 Bit 2	Int	Read	None	Message Not Present	0	None
				Message Present	1	None

Service

The DTU18 features a service reminder system that will inform the user when the module is due its service.

Reminder

Enabled

Set's whether the service reminder is enabled or not.

Requires service security code prior to use.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Interval

Specify the number of days between servicing.

Requires service security code prior to use.

Register/s	Type	Access	Condition/s	Value Limits	Units
App Only					

Date

The date of the next service reminder.

Requires service security code prior to use.

Register/s	Type	Access	Condition/s	Value Limits	Units
App Only					

Update

Set the next service date to the current date plus the number of interval days.

Requires service security code prior to use.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
App Only						

Defer Once the service alarm has occurred, allows the user to temporarily disable the alarm for 7 days whilst they arrange for a service visit.						
<i>Register/s</i>	<i>Type</i>	<i>Access</i>	<i>Condition/s</i>	<i>Option</i>	<i>Value</i>	<i>Condition/s</i>
<i>App Only</i>						

Appendix A – Radio Declarations

United States (FCC)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canada (ISED)

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Fault Finding

The DTU18 has been designed to include a wide range of self-diagnostic tests, some of which are performed at switch on, and some on a continuous basis. This guide aims to provide a route to diagnosing and correcting any faults that may occur during normal operation. The table shown in the Errors section on page 63 gives a list that the DTU18 generates, along with their probable causes. If after these checks the fault has not been cleared, contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem:

- Serial number of the module.
- The approximate date of purchase.
- Details of the program settings and application.
- Electrical environment and supply details.
- Circumstances under which the fault occurred.
- The nature of the fault or faults.
- Any error messages that are displayed.
- The sensor type, cable length and cable type.
- Current output configuration.
- Digital Output configuration.
- Digital Input configuration.

It is often worthwhile to check the measurement by an independent method, for example using a handheld meter.

The Module Appears Dead

Check that power is available to the unit. Using a voltmeter, set to DC, check the power supply voltage at the connector. The design of the DTU18 allows the unit to accept from 12 to 30V DC. Check that the power cable is securely and correctly attached. There are no user serviceable fuses fitted within this unit.

The Access Code Does Not Work

It is probable that the access code has either been changed or the operator does not recall the code correctly. Contact LTH or your local distributor should this problem arise.

The display reads ---.-

- Check the sensor is wired up correctly (see page 19)
- Check for damage to the connecting cable.
- Check that all input connections are secure.
- Check the sensor address in the channel menu matches the last digit of the sensor's serial number except for 0 which equals 10.
- Unless previously told differently check the sensor baud rate in the channel menu equals the default value of 9600.

The Sensor Reading Is Incorrect

- Check the condition of the sensor's lens.
- Check the installation is not being affected by external light sources.
- Check the sensor face is not being contaminated with bubbles.
- If another sensor is available, this can be used to determine whether the fault lies with the module or the sensor.
- Check that the sensor cable is not damaged or broken and that the outer screen does not contact any other terminals or metal work.
- Check that the sensor cable is sufficiently distant from power cables or electrical noise sources.

- Check that the correct scale has been selected.
- Check that the correct sensor calibration values have been used.
- Check that the calibration procedure has been followed precisely.

Current Output is Incorrect or Noisy

- Check that the maximum load for the current loop has not been exceeded (750Ω).
- Check that the terminals have been wired correctly.
- Check that the cable screen is attached to Earth at one end and that the cable does not pass too close to a power cable.
- Check that the current output has been configured properly.

Guarantee and Service

Products manufactured by LTH Electronics Ltd are guaranteed against faulty workmanship and materials for a period of three years from the date of despatch, except for finished goods not of LTH manufacture, which are subject to a separate agreement.

All sensors made by LTH Electronics Ltd are thoroughly tested to their published specification before despatch. As LTH have no control over the conditions in which their sensors are used, no further guarantee is given, although any complaints concerning their operation will be carefully investigated.

Goods for attention under guarantee (unless otherwise agreed) must be returned to the factory carriage paid and, if accepted for free repair, will be returned to the customer's address free of charge. Arrangements can also be made for repair on site; in which case a charge may be made for the engineer's time and expenses.

If any services other than those covered by the guarantee are required, please contact LTH direct.

N.B. Overseas users should contact their LTH nominated representative. Special arrangements will be made in individual cases for goods returned from overseas.



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